Acromag®

IntelliPack Series 801A Alarms
mV/TC/RTD Input

USER'S MANUAL

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Safety Summary - Symbols on equipment:

Means "Caution, refer to this manual for additional information".

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IMPORTANT SAFETY CONSIDERATIONS

It is very important for the user to consider the possible adverse effects of power, wiring, component, sensor, or software failures in designing any type of control or monitoring system. This is especially important where economic property loss or human life is involved. It is important that the user employ satisfactory overall system design. It is agreed between the Buyer and Acromag, that this is the Buyer's responsibility.

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1.0 INTRODUCTION

These instructions cover hardware functionality of the alarm models listed in Table 1. Supplementary sheets are attached for units with special options or features.

Table 1: Models Covered in This Manual

Series/ Input/Type	-Options/Output/ Enclosure/Approvals[1]	-Factory Configuration[2]
801A	-0200	-C (optional)
801A	-0100	-C (optional)

Notes (Table 1):
1. Agency approvals include CE, UL Listed, and cUL Listed.
2. Include the "-C" suffix to specify optional factory configuration. No suffix required for standard configuration.

Module programming, alarm operation, and the IntelliPack Configuration Software is covered in the IntelliPack Alarm Configuration Manual (8500-563).

DESCRIPTION

The Series 801A Alarm is another member of the popular Acromag IntelliPack Alarm & Transmitter family and these models accept DC millivoltage, thermocouple (TC), or resistance temperature detector (RTD) inputs. Output options are two Single-Pole Double-Throw (SPDT) electromechanical relays, or one Double-Pole Double-Throw (DPDT) electromechanical relay. All units contain an advanced technology microcontroller with integrated downloadable flash memory and EEPROM for non-volatile program, configuration, calibration, and parameter data storage. Units are fully reconfigurable via a user-friendly Windows 95® or NT® IntelliPack Configuration Program. Limited field reprogrammability is also accomplished with module push buttons and status LED's. Once configured, these modules may operate independent of the host computer for true embedded monitoring and control.

Each module provides a single input for either DC millivolts, thermocouple, or RTD signals. RTD sensor excitation, linearization, lead-wire compensation, and lead break detection are included. Thermocouple reference-junction compensation, linearization, and open circuit or TC break detection is also provided. Each relay has a yellow LED on the front of the module that provides a visual indication of the high or low alarm condition. Additionally, a green "Run" and yellow "Status" LED provides local feedback of the operating mode, field configuration status, and system diagnostics. Front panel push buttons are available to reset the optional latching alarms and to facilitate field configuration.

The module uses a high resolution, low noise, Sigma-Delta Analog to Digital Converter (Σ-Δ ADC) to accurately convert the input signal into a digital value. User-defined alarm setpoints are compared to this digital value and are used to control the built-in alarm relay(s). Each relay operates independently and may have separate functions assigned. Alarm setpoints and deadband may be adjusted over the full input range of the unit. Relay actuation is user-selected for failsafe or non-failsafe operation. Relays may also be configured as latching, in which case a push button reset is required to reset the latch (this may also be accomplished via software control). Additionally, a programmed relay time delay may be applied to filter transients and minimize nuisance alarms.

Wide alarm functionality and convenient reconfigurability makes these alarms extremely powerful and flexible over a broad range of applications. These models may be configured as limit alarms, window alarms, on/off controllers, peak detect alarms, or rate-of-change alarms, and other functions are possible (please consult the factory).

All IntelliPack modules are designed to withstand harsh industrial environments. They feature RFI, EMI, ESD, SWC, and EFT protection, plus low temperature drift, wide ambient temperature operation, and isolation from input, to power and relay contacts. Units are also wide-range DC-powered and the power input terminal is diode-coupled. This provides reverse polarity protection and allows the module to be powered from DC power networks that incorporate battery back-up power. The unit may connect to redundant power supplies, or several units may safely share a single DC supply.

Units are DIN rail mounted and removable terminal blocks facilitate ease of installation or replacement, without having to remove wiring. Alarm relay and power wiring are inserted at one side of the unit, while input wiring is inserted at the other side. Connectors are an industry standard screw clamp type and accept a wide range of wire sizes.

The safe, compact, rugged, reconfigurable, and reliable design of this alarm makes it an ideal choice for control room and field applications. Custom alarm configurations are also available (please consult the factory).

Key IntelliPack 801A Features

- **Agency Approvals** - CE, UL Listed, & cUL Listed.
- **Windows® Configuration** - Fully configurable via our user friendly Windows 95® or NT® Configuration Program.
- **Nonvolatile Reprogrammable Memory** - This module has an advanced technology microcontroller with integrated, non-volatile, downloadable flash memory and EEPROM.
- **Convenient Field Reprogrammability** - The unit includes push-button reconfiguration of key alarm functions in combination with LED indicators to facilitate in-field changes without having to connect a host computer.
- **Wide Alarm Functionality** - The unit is configurable for a wide range of alarm types including limit, window, on/off controller, peak detection, or rate-of-change alarms. Other functions are possible (consult the factory).
- **Flexible DC Voltage, Thermocouple, or RTD Inputs** - Accepts either DC voltage, thermocouple, or RTD input signals. Linearization, lead break detection, and TC reference-junction compensation are included.
- **True 4-Wire Kelvin Measurement** - Improves performance of 4-wire RTD measurements.
- **High-Power SPDT or DPDT Relays** - The module includes either one Double-Pole-Double-Throw (DPDT) electro-mechanical relay, or two Single-Pole-Double-Throw (SPDT) electro-mechanical relays for switching voltages to 230VAC at currents up to 5A.
- **Fully Isolated** - Input, power, and relay contacts are all isolated from each other.
- **Self-Diagnostics** - Built-in routines operate upon power-up for reliable service, easy maintenance, and troubleshooting.

Key IntelliPack 801A Features…continued

- **LED Indicators** - A green LED indicates power. A yellow status LED will turn on for an open sensor or if the input signal is out of range. A yellow alarm LED indicates when a relay is in alarm. These LED's also have other functions in field program mode.
- **Wide-Range DC-Powered** - This device receives power over a wide DC supply range and the power terminal is diode-coupled for reverse polarity protection. This makes the alarm useful for systems with redundant supplies, and/or battery back-up power.
- **Wide Ambient Operation** - The unit is designed for reliable operation over a wide ambient temperature range.
- **Hardened For Harsh Environments** - The unit will operate reliably in harsh industrial environments and includes protection from RFI, EMI, ESD, surges, and EFT, plus low radiated emissions per CE requirements.
- **Convenient Mounting, Removal, & Replacement** - DIN-Rail mounting and plug-in type terminal blocks for input, power, and relay contact wiring make replacement and removal easy.
- **High-Resolution Precise A/D Conversion** - Alarms include an advanced, high-resolution, low noise, Sigma-Delta Analog to Digital Converter (Σ-Δ ADC) for high accuracy and reliability.
- **Individual Relay Functionality** - Each relay may be configured for a different function.
- **Failsafe or Non-Failsafe Relay Operation** - The unit may be configured for failsafe or non-failsafe relay operation.
- **Configurable Setpoint With Deadband** - Configurable deadband is associated with each setpoint to eliminate relay "chatter" and prolong contact life.
- **Configurable Latching or Momentary Alarms** - These alarms may be configured for automatic alarm reset, or latching alarm with manual push-button or software reset.
- **Configurable Relay Time Delay Filters Transients** - Useful for increased noise immunity and to filter transients.

ACCESSORY ITEMS

The following IntelliPack accessories are available from Acromag. Acromag also offers other standard and custom alarm and transmitter types to serve a wide range of applications (please consult the factory).

IntelliPack Configuration Software (Model 5030-881)

IntelliPack alarms and transmitters are configured using this user-friendly Windows 95® or NT® Configuration Program. This software includes the IntelliPack Alarm Configuration Manual (8500-563) and IntelliPack Transmitter Configuration Manual (8500-570). These manuals describe the software operation and various alarm and transmitter functions in detail. All alarm functions are programmable and downloadable to the alarm modules via this software. Additionally, this software can also be used to monitor input values and alarm status, calibrate the input and CJC circuits, reset the module or reset latched alarms. It also allows optional user-information to be written to the module, such as: tag number, comment, configured by, location, and identification information. Further, it provides a convenient method of printing the module's configuration in an easy to read one or two page format.

IntelliPack Serial Port Adapter (Model 5030-913)

The IntelliPack Serial Port Adapter serves as an isolated interface converter between the EIA232 serial port of the host computer and the Serial Peripheral Interface (SPI) port of the IntelliPack module. It is used in conjunction with the Acromag IntelliPack Configuration Software to program and configure the modules. A separate cable is required to connect the adapter to the module. The adapter has a DB9S connector that mates to the DB9P connector typically available at the serial port of the host computer. The adapter also has a 6-wire RJ11 phone jack to connect to the IntelliPack alarm module via an interconnecting cable (described below). This adapter connects to the host computer's EIA232 port and operates transparent to the user. It requires no user adjustment and no external power. The adapter receives its power from the IntelliPack module. Refer to Drawing 4501-635 for computer to IntelliPack connection details.

IntelliPack Cable (Model 5030-902)

This 6-wire cable is used to connect the SPI port of the Serial Port Adapter to the IntelliPack module. This cable carries the SPI data and clock signals, reset signal, and +5V power & ground signals. The cable is 7 feet long and has a 6-wire RJ11 plug connector at both ends which snap into jacks on the Serial Port Adapter and the IntelliPack module.

IntelliPack Interface Package (Model 800C-SIP)

The IntelliPack Interface Package combines the Configuration Software (5030-881), Alarm Configuration Manual (8500-563), Transmitter Configuration Manual (8500-570), Serial Port Adapter (5030-913), and Cable (5030-902), into a complete kit for interfacing with IntelliPack Alarms and Transmitters.

2.0 PREPARATION FOR USE

UNPACKING AND INSPECTION

Upon receipt of this product, inspect the shipping carton for evidence of mishandling during transit. If the shipping carton is badly damaged or water stained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is absent when the carton is opened and the contents of the carton are damaged, keep the carton and packing material for the agent's inspection.

CAUTION
SENSITIVE ELECTRONIC DEVICES
DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC, MAGNETIC OR RADIOACTIVE FIELDS

This module is physically protected with packing material and electrically protected with an anti-static bag during shipment. However, it is recommended that the module be visually inspected for evidence of mishandling prior to applying power.

This circuit utilizes static sensitive components and should only be handled at a static-safe workstation.

For repairs to a product damaged in shipment, refer to the Acromag Service Policy to obtain return instructions. It is suggested that salvageable shipping cartons and packing material be saved for future use in the event the product must be shipped.

INSTALLATION

The alarm module is packaged in a general purpose plastic enclosure. Use an auxiliary enclosure to protect the unit in unfavorable environments or vulnerable locations, or to maintain conformance to applicable safety standards. Stay within the specified operating temperature range for rated performance. As shipped from the factory, the unit is factory calibrated for all valid input ranges and has the default configuration shown in Table 3:

Table 3: 801A Default Factory Configuration & Calibration

PARAMETER	CONFIGURATION	
Input	TC Type J	
Temp Units	°C	
Cold Junction Compensation	On	
Break Detection	Upscale	
RTD Wiring	3-Wire	
	ALARM 1	**ALARM 2***
Configuration	Limit	Limit
Mode	High Limit	Low limit
Setpoint	200°C	100°C
Deadband	1°C	1°C
Time Delay	200ms	200ms
Operating Mode	Failsafe	Failsafe
Reset	Auto (Momentary)	Auto (Momentary)

* Shaded entries apply only to 801A-0200 units.

Your application may differ from the default configuration and will require the alarm to be reconfigured to suit your needs. This is accomplished with Acromag's user-friendly Windows 95®/NT® Configuration Program and Serial Port Adapter. Configuration is normally done prior to field installation since field configurability via the module's push-buttons is generally limited to setpoint and deadband adjustments where applicable. See the Alarm Configuration Manual 8500-563 for instructions.

Mounting: Refer to Enclosure Dimensions Drawing 4501-631 for mounting and clearance dimensions.

DIN Rail Mounting: This module can be mounted on "T" type DIN rails. Use suitable fastening hardware to secure the DIN rail to the mounting surface. Units may be mounted side-by-side on 1-inch centers for limited space applications.

"T" Rail (35mm), Type EN50022: To attach a module to this style of DIN rail, angle the top of the unit towards the rail and locate the top groove of the adapter over the upper lip of the rail. Firmly push the unit towards the rail until it snaps solidly into place. To remove a module, first separate the input terminal block(s) from the bottom side of the module to create a clearance to the DIN mounting area. Next, insert a screwdriver into the lower arm of the DIN rail connector and use it as a lever to force the connector down until the unit disengages from the DIN rail.

Electrical Connections

Terminals can accommodate wire from 12-24 AWG, stranded or solid copper. Strip back wire insulation 1/4-inch on each lead before installing into the terminal block. Input wiring may be shielded or unshielded twisted pair. Since common mode voltages can exist on signal wiring, adequate wire insulation should be used and proper wiring practices followed. It is recommended that alarm contacts and power wiring be separated from the input signal wiring for safety and low noise pickup. Input, power, and relay terminal blocks are plug-in type and can be easily removed to facilitate module removal or replacement without removing individual wires. Be sure to remove power and/or disable the load before unplugging the terminals to uninstall the module, installing or removing jumpers, or before attempting service. All connections must be made with power removed.

CAUTION: Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.

1. **Power:** Refer to Electrical Connections Drawing 4501-637. Variations in power supply voltage within rated limits has negligible effect on module accuracy. For supply connections, use No. 14 AWG wires rated for at least 75°C. The power terminal is diode-coupled for reverse polarity protection.
2. **Input:** Connect input per Electrical Connections Drawing 4501-637. Observe proper polarity when making connections (see label for input type). Note that one or more input jumpers may be required depending on your input type.
3. **Output Contacts**: Wire relay contacts as shown in Electrical Connections Drawing 4501-637. See the "Alarm Relay Specifications" for power capacity. If necessary, an interposing relay can be used to switch higher currents as shown in Interposing Relay Connection Drawing 4501-634.
   Electromechanical Relay Contact Protection: To maximize relay life with inductive loads, external protection is required. For DC inductive loads, place a diode across the load (1N4006 or equivalent) with the cathode to (+) and anode to (-). For AC inductive loads, place a Metal Oxide Varistor (MOV) across the load. See Relay Contact Protection Drawing 4501-628 for details.
   IMPORTANT: Noise and/or jitter on the input signal has the effect of reducing (narrowing) the instrument's deadband and may produce contact chatter. The long term effect of this will reduce the life of mechanical relays. To reduce this undesired effect, you should increase the effective deadband.
4. **Grounding:** See Electrical Connections Drawing 4501-637. The module housing is plastic and does not require an earth ground connection.

WARNING: For compliance to applicable safety and performance standards, the use of shielded cable is recommended as shown in Drawing 4501-637. Further, the application of earth ground must be in place as shown. Failure to adhere to sound wiring and grounding practices may compromise safety and performance.

3.0 MODULE CONFIGURATION

The alarm module needs to be configured for your application. Alarm configuration is done using Acromag's Windows 95® or NT® Configuration Program and the IntelliPack Serial Port Adapter. Configuration details are covered in Alarm Configuration Manual 8500-563. Field configuration via the module's push-buttons and LED's is covered below.

FIELD CONFIGURATION

This program mode allows adjustment to key alarm parameters in the field, without having to connect a host computer. Field reconfigurability is accomplished via the alarm module's "MODE" and "SET" push buttons and the alarm LED's (see Drawing 4501-631). Field reconfiguration via these controls will vary depending on the alarm function (see Table 6).

Equipment Required

- An accurate input source (voltage or resistance) adjustable over the range required for alarm setpoint and dropout. A thermocouple or RTD calibrator may also be used.
  Note: For best results, the input source must be accurate beyond the required specifications. For voltage inputs, use a voltage source with an output impedance of 100Ω or less.

General Field Programming Procedure

The following procedure uses the corresponding relay LED indicators to indicate which relay parameters (relay 1 or 2) are being modified (see Table 6).

CAUTION: To avoid damage to the unit, do not insert sharp or oversized objects into the push-button switch openings. When depressing the push-buttons, use a blunt tipped object and apply pressure gradually until you feel or hear the tactile response.

1. Connect a precision voltage source, thermocouple calibrator, or RTD calibrator to the input, as required (refer to Electrical Connections Drawing 4501-637). Be sure to include input terminal jumpers according to your input type.
2. Apply power and wait for the module's green "Run" LED to light (continuous ON).
3. Press and hold the "**MODE"** push button until the green "Run" LED goes out, and the relay 1 LED lights (see Table 6). In this mode, the unit is ready to accept an input for parameter 1 of relay 1 per Table 4 below. If you do not wish to change this parameter, skip to step 6.
4. Adjust the input source(s) to the relay parameter 1 level shown in Table 4 according to your alarm function.

Table 4: Relay Config Parameter 1 Per Alarm Function

ALARM FUNCTION	PARAMETER 1
Limit Alarm	High or Low Setpoint Level
Window Alarm	High Setpoint Value
On/Off Controller	Controller "On" Setpoint Value
Peak/Valley Detector	Peak/Valley Detect Start Value
Rate-of-Change Alarm	Rate-Of-Change Threshold

5. Press the **"SET"** push button to accept the relay 1 parameter indicated in Table 4. Note that every time the "**SET"** button is pressed, the yellow "Status" LED will flash once and the value at the input will be captured.

General Field Programming Procedure…continued

6. Press the **"MODE"** push button once. The relay 1 LED should start flashing (see Table 6). The unit is ready to accept the second parameter for the relay as in Table 5:

Table 5: Relay Config Parameter 2 Per Alarm Function

ALARM FUNCTION	PARAMETER 2
Limit Alarm	Setpoint Dropout Value
Window Alarm	Low Setpoint Value
On/Off Controller	Controller "Off" Setpoint Level
Peak/Valley Detector	Peak or Valley Dropout Value
Rate-of-Change	Dropout Rate for Rate-of-Change

7. Adjust the input source to the desired level.
8. Press the **"SET"** button to accept the parameter noted in Table 5 for your alarm function. The module will use the difference between the two programmed parameter values to calculate deadband where applicable.
9. If two relays are to be programmed, press the **"MODE"** button again to complete the first relay program cycle and then repeat the above procedure (steps 4-8) to configure parameters for relay 2 (relay 2 LED will light, "Run" LED will still be off).
10. After configuring relay 1, and relay 2 (where applicable), press the "**MODE"** push button again to complete the program sequence and return to run mode. The green "Run" LED will turn ON. This indicates the unit has returned to the operating mode and the yellow relay LED's will now reflect actual alarm status per your application.

Notes (Field Program Procedure):

1. During field configuration of dual relay models, the relay LED will be ON or FLASHING, corresponding to the relay being programmed and the parameter being adjusted as in Table 6:

Table 6: Field Configuration Relay LED Mode Indication

ALARM FUNCTION	RELAY 1 or 2 LED	
	ON	FLASHING
Limit	HI/LO Setpoint	HI/LO Dropout
Window	High Setpoint	Low Setpoint
ON/OFF Controller	ON Setpoint	OFF Setpoint
Peak/Valley Detect	P/V Detect Start	P/V Dropout
Rate-Of-Change	ROC Threshold	ROC Dropout

2. To summarize, the green "Run" LED is turned off in field configuration mode. The yellow "Status" LED blinks each time [SET] is pressed in configuration mode to indicate that the current input level has been captured. The yellow relay LED's are ON or flashing according to the parameter being set and the relay being programmed in configuration mode.
3. If the alarm is in field configuration mode and no push buttons are pressed after 2 minutes, then the alarm will return to normal operating mode, the green "Run" LED will light, and no changes will be made to the previously configured values.
4. Latching alarms require a push button reset to exit the alarm state (this may also be accomplished under software control).
5. Deadband and latching relays have no application with respect to on/off controller functionality.
6. Rate-of-change units (volts/second) are software configured only and not configured via the module's push-buttons.
7. Note that alarm operating functions may be selected on a per relay basis. For example, relay 1 could function as a "limit alarm" monitoring the input, while relay 2 (if present) functions as an "on/off controller" monitoring the input.

4.0 THEORY OF OPERATION

Refer to Drawing 4501-628 to gain a better understanding of the circuit. Note that these alarms will pre-filter a signal and convert the signal to a scaled voltage. An A/D converter stage then applies appropriate gain to the signal, digitally filters it, and performs analog-to-digital conversion. The digital signal is then transmitted serially to a microprocessor. The microprocessor compares the signal value to the limit value according to the alarm type, and completes all necessary alarm functions per its embedded program. The program configuration and calibration parameters are stored in non-volatile memory within the microcontroller. A wide input switching regulator (isolated flyback mode) provides isolated +5V power to the circuit.

5.0 SERVICE AND REPAIR

CAUTION: Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.

SERVICE AND REPAIR ASSISTANCE

This module contains solid-state components and requires no maintenance, except for periodic cleaning and alarm configuration parameter (setpoint, deadband, etc) verification. Since Surface Mounted Technology (SMT) boards are generally difficult to repair, it is highly recommended that a non-functioning module be returned to Acromag for repair. The board can be damaged unless special SMT repair and service tools are used. Further, Acromag has automated test equipment that thoroughly checks and calibrates the performance of each module. Please refer to Acromag's Service Policy Bulletin or contact Acromag for complete details on how to obtain service parts and repair.

PRELIMINARY SERVICE PROCEDURE

Before beginning repair, make sure all installation and configuration procedures have been followed. The unit routinely performs internal diagnostics following power-up or reset. During this period, all LED's will turn ON momentarily, and the green "Run" LED flashes. If the diagnostics complete successfully, the "Run" LED will stop flashing after two seconds and remain ON. This indicates the unit is operating normally. If the "Run" LED continues to flash, this is indicative of a problem. In this case, use the IntelliPack Configuration Software to reconfigure the module or re-download its firmware, and this will usually cure the problem. If the diagnostics indicate a problem via a continuously flashing green LED, or if other evidence points to a problem with the unit, an effective and convenient fault diagnosis method is to exchange the questionable module with a known good unit.

The IntelliPack Serial Port Adapter contains a red LED visible at the small opening in the enclosure to the right of the RJ11 receptacle. If this LED is OFF or Flashing, then a communication interface problem exists. Note that the adapter receives its power from the IntelliPack module. A constant ON LED indicates a properly working and powered serial interface adapter.

Acromag's Application Engineers can provide further technical assistance if required. When needed, complete repair services are also available from Acromag.

6.0 SPECIFICATIONS

801A-0200-C, Single mV/TC/RTD Input, Dual SPDT Relays
801A-0100-C, Single mV/TC/RTD Input, Single DPDT Relay

General: The IntelliPack Model 801A is a DC-powered alarm which conditions either a single thermocouple, RTD, millivolt, or resistance input, and provides either two Single-Pole Double-Throw (SPDT) electromechanical alarm relays, or one Double-Pole Double-Throw (DPDT) electromechanical alarm relay. Isolation is supplied between the sensor input, the relay contacts, and power. This alarm is DIN-rail mounted.

The unit is configured and calibrated using our user-friendly Window 95® or NT® IntelliPack Configuration Program. Push-buttons on the module allow field adjustment of setpoint and deadband (where applicable). All calibration and configuration information is stored in non-volatile reprogrammable memory in the module.

MODEL NUMBER DEFINITION

IntelliPack Alarms are color coded with a yellow label. The prefix "8" denotes the IntelliPack Series 800, while the "A" suffix specifies that outputs are alarm contacts.

801A: Monitors a single DC millivoltage, thermocouple (TC), or resistance temperature detector (RTD) input.

-0x00: Numbers in this model suffix represent the following options, respectively:

Options = 0: None (reserved for future use);
Output = 1 - One DPDT relay, 2 - Two SPDT relays;
Enclosure = 0: DIN rail mount (described below);
Approvals = 0: CE, UL Listed, and cUL Listed.

INPUT SPECIFICATIONS

Unit must be wired and configured for the intended input type and range (see Installation Section for details). The following paragraphs summarize this model's input types, ranges, and applicable specifications.

RTD: User configured to one of four RTD types as shown in Table 7. Module provides sensor excitation, linearization, lead-wire compensation, and sensor break detection.
Reference Test Conditions: Input Pt RTD; Limit Alarm Setpoint at 100°C (Ni), 50°C (Cu), 250°C (Pt); Deadband = 1°C; Alarm Type = Failsafe High Limit; Ambient Temperature = 25°C; Power Supply = 24V DC; Alarm Delay = 200ms.
Input Configuration: Two, three, or four-wire (Kelvin or compensation loop).
Excitation Current: 1mA DC typical, all types.
Linearization: Better than ±0.25°C, typical.
Lead-Wire Compensation: Inherent for 3 wire and 4 wire RTD's. The maximum lead resistance is 25Ω per lead (Pt), 20Ω per lead (Ni), 10Ω per lead (Cu). All lead wires must be of equal size and length.
Lead Resistance Effect: 3.5°C per Ω of unbalance (Pt), typical, 1.4°C per Ω of unbalance (Ni), typical, 25.5°C per Ω of unbalance (Cu), typical.

Break Detection: RTD sensor failure can be configured for either upscale or downscale detection. Note that an RTD measurement of exactly 0Ω will be detected as a break.

Table 7: RTD Types, Ranges, and Accuracy

RTD Type	α[1] Alpha	C Range	Typical Accuracy
Pt 100Ω (DIN/IEC/JIS 1989)	1.3850	-200 to +850°C	±0.25°C
Pt 100Ω (Old JIS 1981)	1.3911	-200 to +850°C	±0.25°C
Ni 120Ω (Minco 7-120)	1.6720	- 80 to +320°C	±0.25°C
Cu 10Ω (Minco 16-9)	1.4272	-200 to +260°C	±1.00°C
Resistance (Linear)[2]	1.000	0-500Ω[2]	±0.05Ω

Notes (Table 7):
1. Alpha (α) is used to identify the particular RTD curve. The value of alpha is derived by dividing the resistance of the sensor at 100°C by the resistance at 0°C ($\alpha = R_{100°C}/R_{0°C}$). For Pt 100Ω, this is 138.50Ω/ 100.00Ω, or 1.3850 (also shown as 0.00385Ω/Ω/°C).
2. The linear resistance input range approaches 0Ω, but does not include 0Ω. If exactly 0Ω is measured, the selected break detection is triggered.

Thermocouple: User configured for 8 types of thermocouples as shown in Table 8. Supports J, K, T, R, S, E, B, and N TC types. Linearization, cold-junction compensation, and open circuit or lead break detection is included.
TC Input Reference Test Conditions: All TC Types With 10mV Setpoints (Example: Type J at 186°C); Deadband = 1°C; Alarm Type = Failsafe High Limit; Ambient Temperature = 25°C; Power Supply = 24V DC, Alarm Delay = 200ms.
TC Input Bias Current: 25nA maximum (TC/mV inputs), 35nA typical (TC break).
Thermocouple Reference: Accurate to better than ±0.4°C typical at 25°C ±0.01°C per °C over temperature.
TC Linearization: Within ±0.25°C of the NIST tables.
TC Break Detection: TC sensor failure can be configured for either upscale or downscale detection.

Table 8: TC Types, Ranges, and Accuracy

TC Type	Material	ISA/ANSI Color	°C Range	Typical Accuracy
J	+Iron, -Constantan	white red	-210 to + 760°C	±0.5°C
K	+Chromel, -Alumel	yellow black	-200 to +1372°C	±0.5°C
T	+Copper, -Constantan	blue red	-260 to + 400°C	±0.5°C
R	+Pt/13%Rh, -Constantan	black red	- 50 to +1768°C	±1.0°C
S	+Pt/10%Rh, -Constantan	black red	- 50 to +1768°C	±1.0°C
E	+Chromel, -Constantan	purple red	-200 to +1000°C	±0.5°C
B	+Pt/10%Rh, -Pt/6%Rh	gray red	+260 to 1820°C	±1.0°C
N	+Nicrosil, -NISIL	orange red	-230 to -170°C, -170 to +1300°C	±1.0°C ±0.5°C

DC Voltage (See Table 9): User-configured for 7 bipolar DC voltage ranges shown in Table 9.
Voltage Input Reference Test Conditions: Input ±15.6mV range; Setpoint at 10mV; Deadband = 0.5mV; Alarm Type = Failsafe High Limit; Ambient Temperature = 25°C; Power Supply = 24V DC; Alarm delay = 200ms.
Input bias current: 25nA maximum.

General Input Specifications
Accuracy: For RTD and TC inputs, see Tables 7 & 8. Voltage input accuracy is better than ±0.05% typical. Accuracy includes repeatability, linearization, reference junction error (TC inputs), but does not include sensor error.
Accuracy Versus Temperature: Better than ±0.005% of input span per °C or ±1uV/°C, whichever is greater.
Resolution: Resolution for each range is given in Table 9.
Response Time: Less than 200ms typical to 98% of final value for a step change in input. Note a software configurable delay can be implemented for filtering transients and this will increase the response time.
Input Filter: Normal mode filtering, plus digital filtering optimized and fixed per input range within the Σ-Δ ADC.
Noise Rejection (Normal Mode): Better than 40dB @ 60Hz, typical with 100Ω input unbalance (10Ω for Cu RTD).
Noise Rejection (Common Mode): Better than 130dB @ 60Hz, typical with 100Ω input unbalance (10Ω for Cu RTD).
Analog to Digital Converter (A/D): A 16-bit Σ-Δ converter, Analog Devices AD7714AR-5.
Conversion Rate: 5 conversions per second.
Overvoltage Protection: Bipolar Transient Voltage Suppressers (TVS) at each lead, 7.6V clamp level typical.

Table 9: Resolution Per Applicable Range

Range	Resolution
±15.6mV	0.78uV
±31.3mV	1.56uV
±62.5mV	3.125uV
±125mV	6.25uV
±250mV	12.5uV
10Ω Cu (α=1.4272)	0.2°C (0.36°F)
±500mV	25uV
±1.0V	50uV
0-500Ω	15.625mΩ
Pt (α=1.3850)	0.1°C (0.18°F)
Pt (α=1.3911)	0.1°C (0.18°F)
Ni (α=1.6720)	0.1°C (0.18°F)
Thermocouples	0.1°C (0.18°F)

RELAY OUTPUT SPECIFICATIONS

DPDT ALARM OUTPUT (-x1xx): These units contain a single DPDT electromechanical relay comprised of two, high reliability, Form C (Normally Open and Normally Closed) contacts.

DPDT Alarm Relay Specifications:
Electrical Life - CSA Ratings:
28VDC, 5A, $3x10^4$ operations, resistive.
250VDC, 0.28A, $3x10^4$ operations, resistive.
250VAC, 5A, $3x10^4$ operations, resistive.
Note: To control a higher amperage device, such as a pump, an interposing relay may be used (see Interposing Relay Connections Drawing 4501-634).
Contact Material: Silver-Nickel (AgNi 90/10).
Initial Dielectric Strength: Between open contacts: >1000VAC rms (1 minute).
Expected Mechanical Life: 30 million operations.
Note: External relay contact protection is required for use with inductive loads (see Relay Contact Protection Drawing 4501-628). Failure to use adequate protection may reduce contact life or damage the unit.
Relay Response (No Relay Time Delay): Relay contacts will switch within 300ms for an input step change from 10% of span on one side of an alarm point to 5% of span on the other side of the alarm point.

SPDT ALARM OUTPUT (-x2xx): These models contain two independent SPDT electro-mechanical relays. Each relay contains high reliability, SPDT, Form C contacts (Normally Open and Normally Closed). Both relays may have different alarm functions assigned to them.

SPDT Alarm Relay Specifications:
Electrical Life - CSA Ratings:
25VDC, 5A, 10^5 operations, resistive.
48VDC, 0.8A, 10^5 operations, resistive.
240VDC, 0.1A, 10^5 operations, resistive.
120VAC/240VAC, 5A, $3x10^4$ operations, resistive.
Note: To control a higher amperage device, such as a pump, an interposing relay may be used (see Interposing Relay Connections Drawing 4501-634).
Contact Material: Silver-cadmium oxide (AgCdO).
Initial Dielectric Strength: Between open contacts: 1000VAC rms.
Expected Mechanical Life: 20 million operations.
Note: External contact protection is required for use with inductive loads (see Contact Protection Drawing 4501-628). Failure to use adequate protection may reduce contact life or damage the unit.
Relay Response (No Relay Time Delay): Relay contacts will switch within 300ms for an input step change from 10% of span on one side of an alarm point to 5% of span on the other side of the alarm point.

ENCLOSURE/PHYSICAL SPECIFICATIONS

Units are packaged in a general purpose plastic enclosure that is DIN rail mountable for flexible, high density (approximately 1" wide per unit) mounting. See Enclosure Dimensions Drawing 4501-631 for details.

Dimensions: Width = 1.05 inch, Height = 4.68 inches, Depth = 4.35 inches (see Drawing 4501-631).
DIN Rail Mounting (-xx0x): DIN rail mount, Type EN50022; "T" rail (35mm).
Connectors: Removable plug-in type terminal blocks; Current/Voltage Ratings: 15A/300V; Wire Range: AWG #12-24, stranded or solid copper; Separate terminal blocks are provided for input, power & relay contacts. For supply connections, use No. 14 AWG copper wires rated for at least 75°C.
Case Material: A general purpose NEMA Type 1 enclosure of self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige.
Printed Circuit Boards: Military grade FR-4 epoxy glass.
Shipping Weight: 1 pound (0.45 Kg) packed.

APPROVALS (-xxx0)

0: Agency Approvals - CE, UL Listed, and cUL Listed. UL3121 First Edition, CSA C22.2 No. 1010.1-92, Low Voltage Directive (72/23/EEC), EMC (89/336/EEC) Directives.

Product approval is limited to the general safety requirements of the above standards.

Warning: This product is not approved for hazardous locations.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: -25°C to +70°C (-13°F to +158°F).
Storage Temperature: -40°C to +85°C (-40°F to +185°F).
Relative Humidity: 5 to 95%, non-condensing.
Power Requirements: +10V Minimum to +36V DC Maximum. Current draw is a function of the supply voltage (see Table 10). Currents given assume the Serial Port Adapter is connected. An internal diode provides reverse polarity protection.

CAUTION: Do not exceed 36VDC peak, to avoid damage to the module.

Table 10: Supply Current

Supply Voltage	Supply Current (Relays Off)	Supply Current (Relays On)
10V	55mA	120mA
12V	50mA	100mA
15V	40mA	75mA
24V	30mA	55mA
36V	25mA	40mA

Note: Disconnecting the Serial Port Adapter will reduce power supply current consumption an average of 15%.

IMPORTANT – External Fuse: If unit is powered from a supply capable of delivering more than 1A to the unit, it is recommended that this current be limited via a high surge tolerant fuse rated for a maximum current of 1A or less (for example, see Bel Fuse MJS1).

Power Supply Effect:
DC Volts: Less than ±0.001% of input span change per volt DC for rated power supply variations.
60/120 Hz Ripple: Less than 0.01% of input span per volt peak-to-peak of power supply ripple.
Isolation: Input, relay contacts, and power are isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). Complies with test requirements outlined in ANSI/ISA-82.01-1988 for voltage rating specified.
Installation Category: Designed to operate in an Installation Category (Overvoltage Category) II environment per IEC 1010-1 (1990).
Radiated Field Immunity (RFI): Complies with IEC1000-4-3 Level 3 (10V/m, 80 to 1000MHz AM & 900MHz keyed) and European Norm EN50082-1.
Electrical Fast Transient Immunity (EFT): Complies with IEC1000-4-4 Level 3 (2KV power; 1KV signal lines) and European Norm EN50082-1.
Electromagnetic Interference Immunity (EMI): No relay trips will occur beyond ±0.25% of input span from setpoint under the influence of EMI from switching solenoids, commutator motors, and drill motors.
Surge Immunity: Complies with IEC1000-4-5 Level 3 (2.0KV) and European Norm EN50082-1.
Electrostatic Discharge (ESD) Immunity: Complies with IEC1000-4-2 Level 3 (8KV/4KV air/direct discharge) to the enclosure port and European Norm EN50082-1.
Radiated Emissions: Meets or exceeds European Norm EN50081-1 for class B equipment.

FIELD CONFIGURATION AND CONTROLS

Field programmability of key alarm functions (e.g. setpoint and deadband) is accomplished with module push buttons and LED indicators. **Note:** The unit must first be configured using the IntelliPack Configuration Software before alarm setpoint or deadband can be changed in the field.

Module Push Buttons (See Dwg 4501-631 for Location):
Mode - Used to change mode of field configuration.
Set - Used to accept input data during field calibration.
Reset 1 - Used to reset a latched alarm for relay 1.
Reset 2 - Used to reset a latched alarm for relay 2.
LED Indicators (See Dwg 4501-631 for Location):
Operating Mode
Run (Green) - Constant ON indicates power is applied and the unit is operating normally. Flashing ON/OFF indicates that unit is performing diagnostics (first second following power-up), or has failed diagnostics (after a few seconds).
Status (Yellow) - Flashing ON/OFF indicates open sensor, lead break, or over/under range condition exists at the input.
Relay 1 Alarm (Yellow) - Constant ON indicates alarm condition for relay 1.
Relay 2 Alarm (Yellow) - Constant ON indicates alarm condition for relay 2.
Field Configuration Mode
Run (Green) - Turned OFF in this mode.
Status (Yellow) - Blinks each time the SET button is pressed to capture an input signal during field configuration mode.
Relay 1 Alarm (Yellow) - Constant ON or flashing ON/OFF indicates whether configuration parameter 1 or 2 of relay 1 is being programmed in this mode (see Table 6).
Relay 2 Alarm (Yellow) - Constant ON or flashing ON/OFF indicates whether configuration parameter 1 or 2 of relay 2 is being programmed in this mode (see Table 6).

HOST COMPUTER COMMUNICATION

Host Communication Port (SPI): The IntelliPack Serial Peripheral Interface (SPI) port utilizes a standard RJ11, 6-wire phone jack. Configuration information is downloaded from the host computer through one of its EIA232 serial ports. The serial port must be connected to the module through an IntelliPack Serial Port Adapter, which serves as an isolated interface converter between EIA232 and the IntelliPack module's SPI port (standard RJ11 phone jack).
Baud Rate (EIA232): 19.2K baud.

SOFTWARE CONFIGURATION

Units are fully reprogrammable via the user-friendly Windows 95® or NT® IntelliPack Configuration Program (Model 5030-881). Reprogrammable non-volatile memory integrated within microcontroller makes remote firmware calibration and configuration changes easy. A cable (5030-902) and converter (5030-913) are required to complete the interface (Software Interface Package 800C-SIP).

The following attributes are selectable via the Configuration Software. Applicable attributes and their functions may vary with respect to the alarm model and operating function. Refer to the IntelliPack Alarm Configuration Manual (8500-563) for a more detailed explanation of these attributes and their application.

Input Configuration

Input Type Selection: The alarm can be configured to accept any of the input types/ranges described in the Input Specifications using the IntelliPack Configuration Software.

Temperature Units: Can be configured to use °C, °F, or K units.

Cold Junction Compensation (CJC, Thermocouple Inputs): Must be set to ON when directly connecting a thermocouple to the module (default). CJC can be set to OFF when connecting a millivolt source, representing temperature, directly to the module's input terminals. **Note:** Before calibrating a TC input with CJC ON, allow the module to warm-up for at least 10 minutes for best performance.

Sensor Break Detection: Temperature sensor failure (TC or RTD) can be configured for upscale or downscale detection.

RTD Input Wiring: The RTD wiring must be specified for proper lead-wire compensation. Alarm can be configured for 2, 3, or 4-wire (Kelvin or compensation loop) RTD sensors.

Input Calibration: The configuration software can be used to calibrate the input conditioning circuit of this module.

Alarm Configuration

Alarm Operating Functions: The following gives a brief description of current available alarm operating functions for this model. Other modes are possible (consult the factory).

Limit Alarm: Relay will enter the alarm state when the user-defined high or low setpoint is exceeded for the specified amount of time. Relay remains in alarm until the input has retreated past the setpoint, plus any deadband, for the specified amount of time. Limit alarms have a single high or low setpoint applied to an input at a time.

Window: The relay will enter the alarm state when either the user-defined high or low setpoint is exceeded for the specified amount of time. Relay remains in alarm until the input signal has retreated past the defined setpoint, plus any deadband, for the specified amount of time. Window alarms have both high and low setpoints on an input at a time.

On/Off Controller: The relay will enter the alarm state when the "on" setpoint has been exceeded for the specified amount of time (this allows input transients to be filtered). The relay remains in the alarm state until the input signal has retreated past the "off" setpoint (deadband not applicable) for the specified amount of time. Note that the latching relay function is not applicable to On/Off Controllers.

Peak/Valley Detection: An alarm is produced for a user defined peak (max) or valley (min) condition of the input signal. The peak/valley detection will not activate until the input signal has exceeded the user-specified peak or valley start sensing level for the user-specified amount of time delay. Once the peak/valley function has been activated, the input is monitored to detect a retreat in the input by an amount specified as the deadband value. When this occurs, the relay will enter the alarm state (no delay applies). The relay remains in alarm until the signal has further retreated beyond a user specified deactivate value (no delay applies). Note if the start value is greater than the deactivate value, then a peak condition will be detected. Otherwise, a valley detection will be made.

Rate-of-Change: The relay will enter the alarm state when the programmed rate-of-change threshold value is exceeded by the input signal's rate-of-change. The relay remains in the alarm state until the input signal's rate-of-change has retreated below a user specified dropout rate-of-change value. The input signal rate-of-change is calculated as a running average of 5 samples over a 1 second time interval (this allows input transients to be filtered). The module always monitors the absolute rate of change in the input signal and will activate with either a positive or negative rate-of-change. The rate-of-change threshold and dropout values (units/second selected during software configuration) may be adjusted in the field via the module's push-buttons & LED's.

Alarm Input: The alarm input signal range is the full range for the configured input type. Example: If a Type J TC was selected using the configuration program, the alarm can be programmed to any setpoint from -200°C to +760°C, independent of input calibration.

Alarm Setpoint: High or low setpoints (plus deadband) may be assigned to each relay and are configurable over the entire input range. The relay will trip on an increasing signal for a high setpoint, and on a decreasing signal for a low setpoint.

Alarm Deadband: Deadband is associated with each setpoint and configurable over the entire input range. Deadband determines the amount the input signal has to return into the "normal" operating range before the relay contacts will transfer out of the "alarm" state. It is normally used to eliminate false trips or alarm "chatter" caused by fluctuations in the input near the alarm point. Deadband may also apply to latched alarms. If the alarm is latching, it is recommended that deadband be set to a minimum.

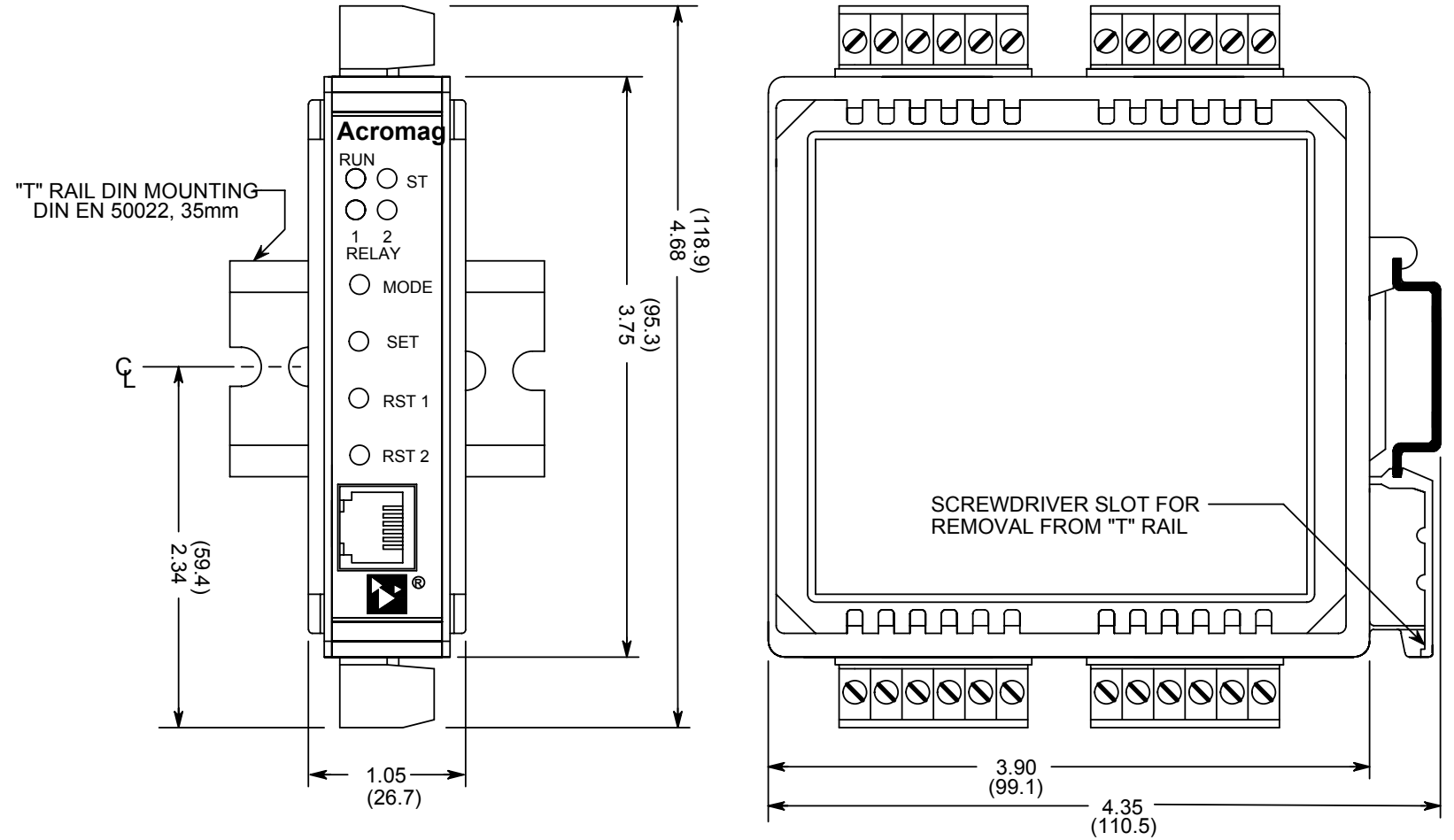
> **IMPORTANT:** Noise and/or jitter on the input signal has the effect of reducing (narrowing) the deadband and may produce contact chatter. Another long term effect of contact chatter is a reduction in the life of the mechanical relay contacts. To reduce this undesired effect, increase the deadband setting.

Relay Alarm Delay: Configurable from 0ms to 4 seconds in 200ms increments for this model (used to help filter input transients and avoid nuisance alarming). A minimum delay of 200ms (default) is recommended for increased noise immunity and conformance to applicable safety standards.

Alarm Indicators: One yellow LED per relay provides a visual status indication of when relays are in alarm.

Automatic Reset or Latching Relay Action: Relays may be configured for auto-reset when the inputs retreat past their setpoints and deadband, or relays may latch into their alarm state. One push-button reset switch per relay is located on the front of the module and is used to exit the latched state (this may also be done via software control). A latched relay cannot be reset until its input signal has returned into its normal operating range with deadband applied and after the relay time delay. Note that when the input returns to, or leaves the normal operating range, the relay and its LED will transfer after the relay time delay has expired. Time delay applies to both activating & deactivating the relay.

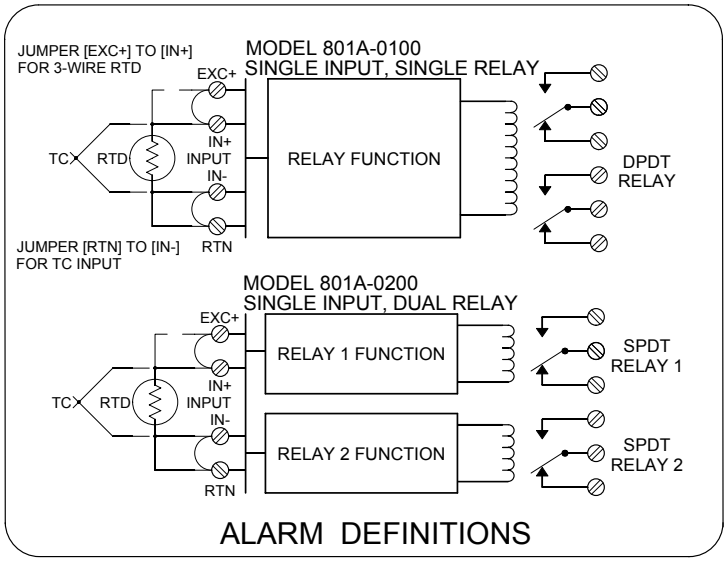
Relay Failsafe/Non-Failsafe Operating Mode: User configurable for "failsafe" operation (relay deenergized in alarm state), or non-failsafe operation (relay energized in alarm state). Failsafe mode provides the same contact closure for alarm states as for power loss, while non-failsafe mode uses alarm contact closure opposite to power loss conditions.



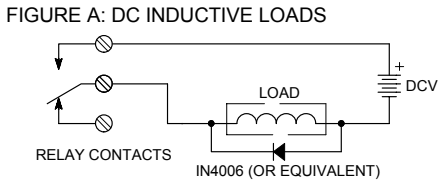
NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

INTELLIPACK ENCLOSURE DIMENSIONS

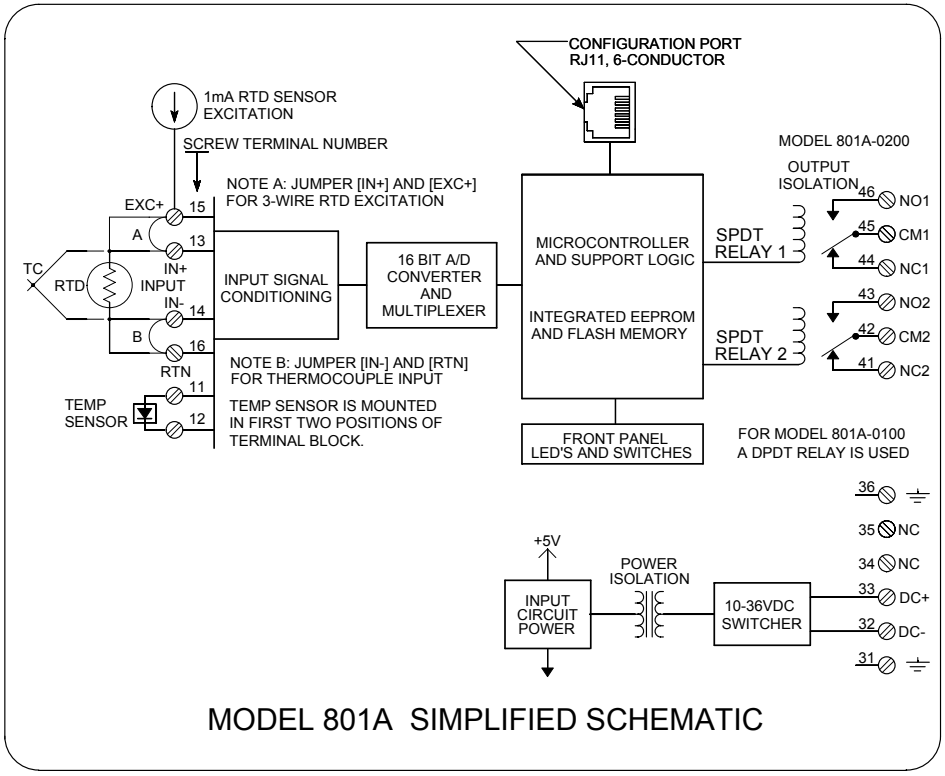
4501-631A



ALARM DEFINITIONS



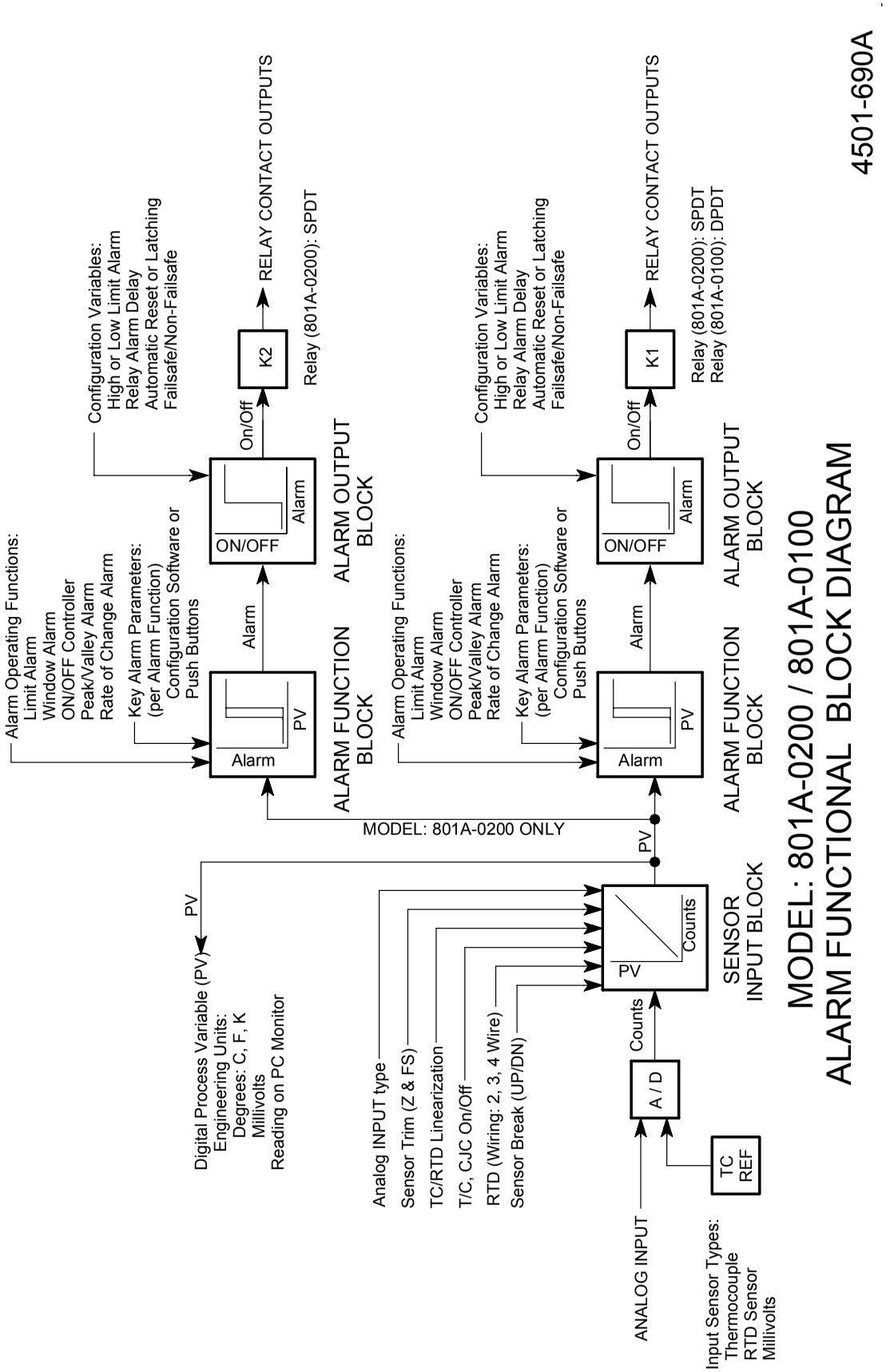
RELAY CONTACT PROTECTION



MODEL 801A SIMPLIFIED SCHEMATIC

MODEL 801A
SIMPLIFIED SCHEMATIC AND
RELAY CONTACT PROTECTION

4501-628B


MODEL: 801A-0200 / 801A-0100
ALARM FUNCTIONAL BLOCK DIAGRAM
4501-690A
ANALOG INPUT
Input Sensor Types:
Thermocouple
RTD Sensor
Millivolts
TC REF
A / D
Counts
SENSOR INPUT BLOCK
PV
Counts
Analog INPUT type
Sensor Trim (Z & FS)
TC/RTD Linearization
T/C, CJC On/Off
RTD (Wiring: 2, 3, 4 Wire)
Sensor Break (UP/DN)
Digital Process Variable (PV)
Engineering Units:
Degrees: C, F, K
Millivolts
Reading on PC Monitor
PV
MODEL: 801A-0200 ONLY
ALARM FUNCTION BLOCK
Alarm
PV
Alarm
Alarm Operating Functions:
Limit Alarm
Window Alarm
ON/OFF Controller
Peak/Valley Alarm
Rate of Change Alarm
Key Alarm Parameters:
(per Alarm Function)
Configuration Software or
Push Buttons
ALARM OUTPUT BLOCK
ON/OFF
Alarm
On/Off
K2
RELAY CONTACT OUTPUTS
Relay (801A-0200): SPDT
Configuration Variables:
High or Low Limit Alarm
Relay Alarm Delay
Automatic Reset or Latching
Failsafe/Non-Failsafe
ALARM FUNCTION BLOCK
Alarm
PV
Alarm
Alarm Operating Functions:
Limit Alarm
Window Alarm
ON/OFF Controller
Peak/Valley Alarm
Rate of Change Alarm
Key Alarm Parameters:
(per Alarm Function)
Configuration Software or
Push Buttons
ALARM OUTPUT BLOCK
ON/OFF
Alarm
On/Off
K1
RELAY CONTACT OUTPUTS
Relay (801A-0200): SPDT
Relay (801A-0100): DPDT
Configuration Variables:
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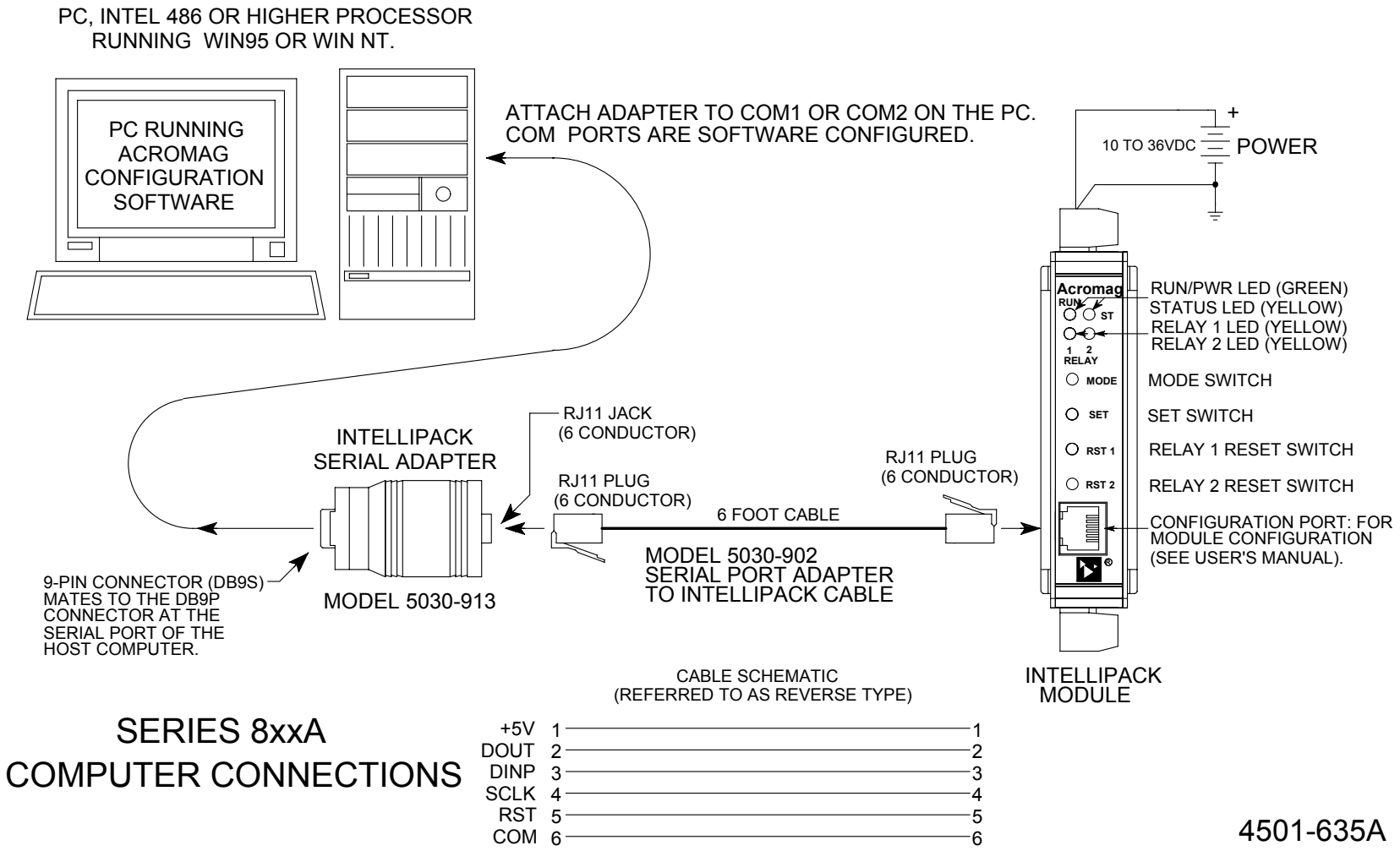
Relay Alarm Delay
Automatic Reset or Latching
Failsafe/Non-Failsafe

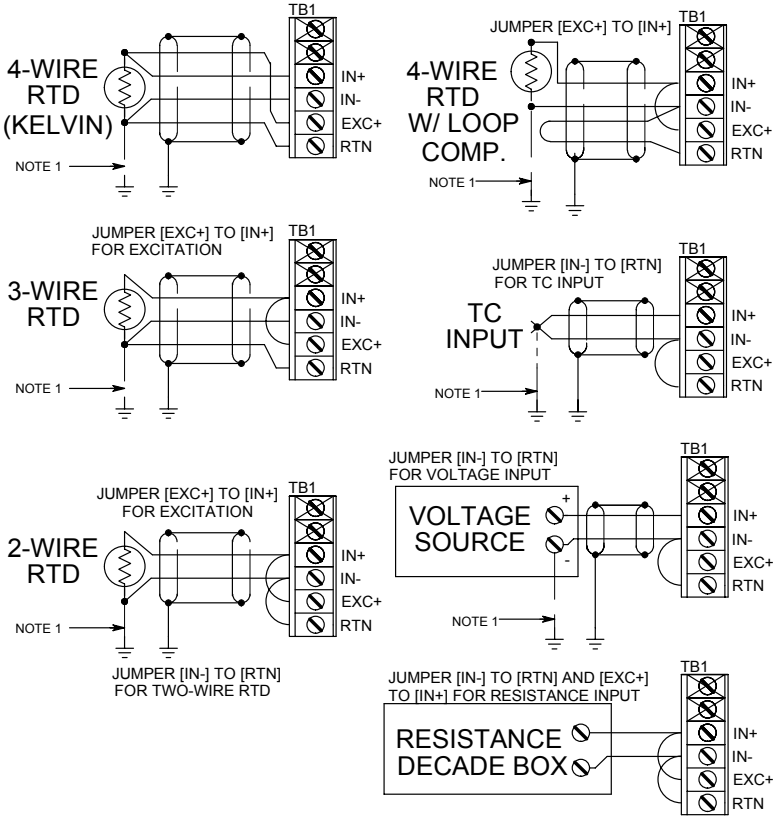


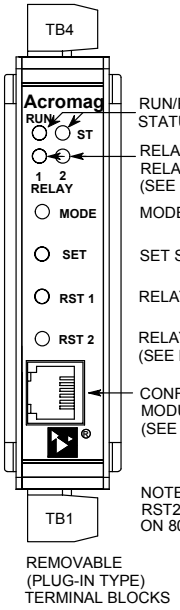
SERIES 8xxA COMPUTER CONNECTIONS

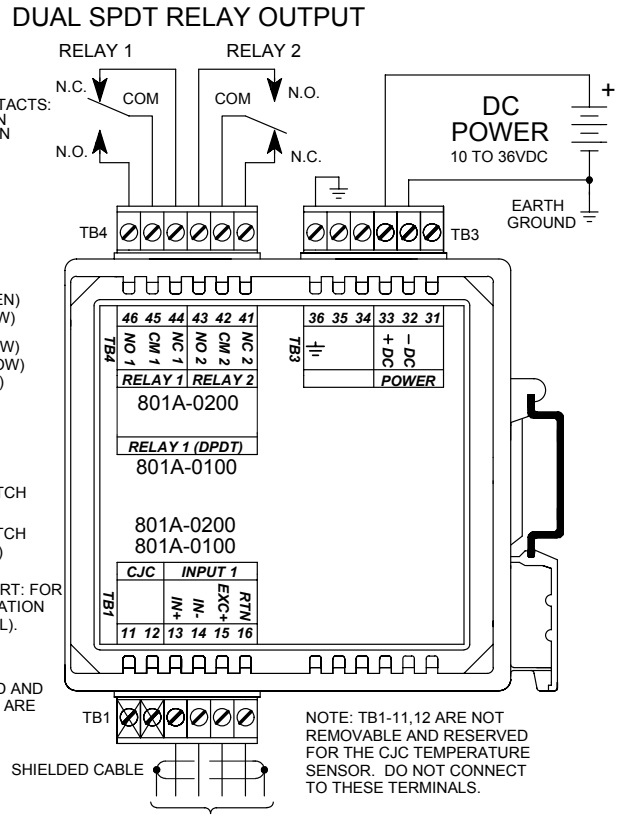
CABLE SCHEMATIC
(REFERRED TO AS REVERSE TYPE)

+5V	1	1
DOUT	2	2
DINP	3	3
SCLK	4	4
RST	5	5
COM	6	6

4501-635A







ELECTRICAL CONNECTIONS
MODELS 801A-0100 AND 801A-0200

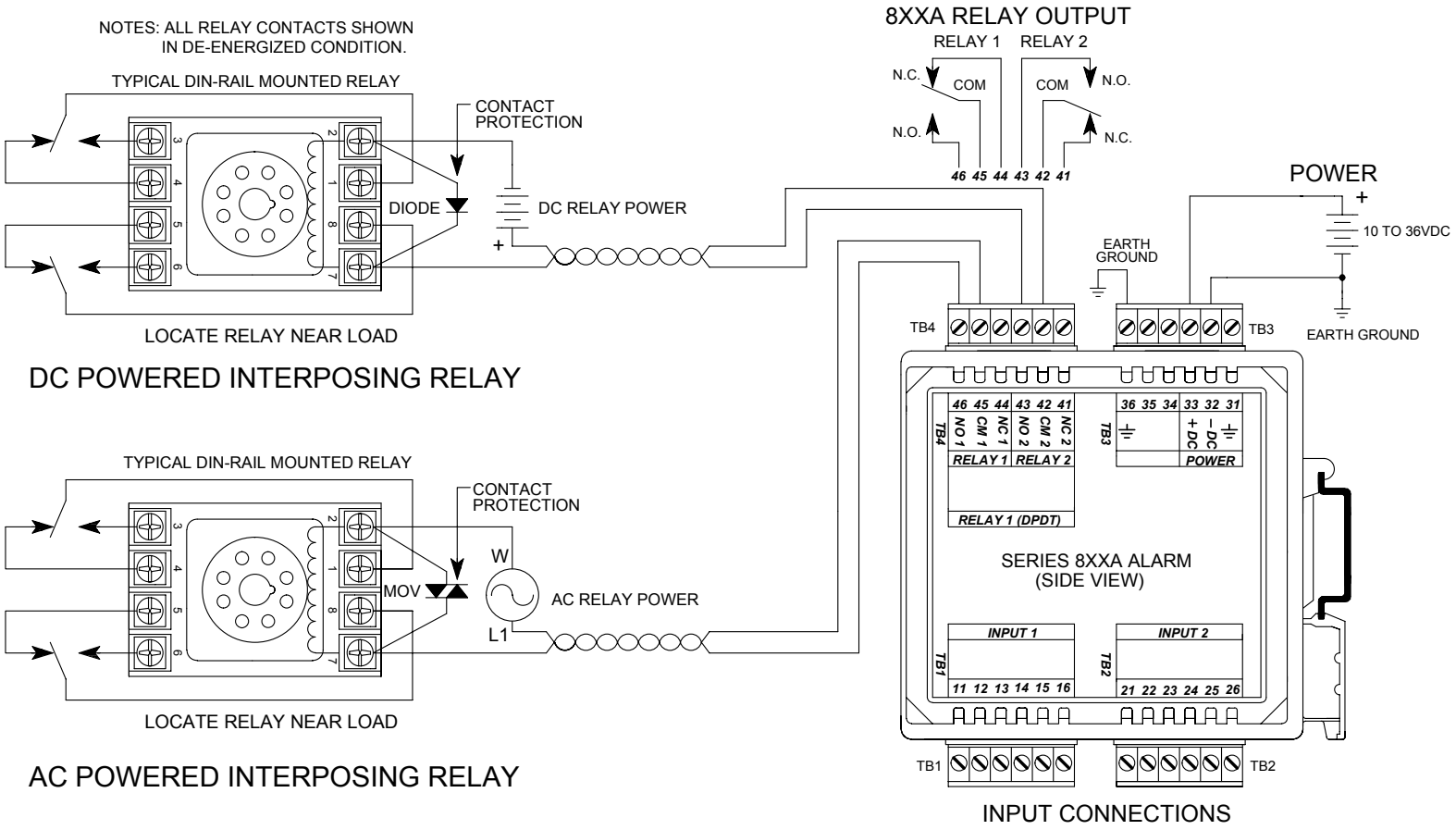
NOTE 1: THIS GROUND CONNECTION IS RECOMMENDED FOR BEST RESULTS. IF SENSORS ARE INHERENTLY CONNECTED TO GROUND, USE CAUTION AND AVOID MAKING ADDITIONAL GROUND CONNECTIONS WHICH COULD GENERATE GROUND LOOPS AND MEASUREMENT ERROR.

WARNING:

FOR COMPLIANCE TO APPLICABLE SAFETY AND PERFORMANCE STANDARDS, THE USE OF SHIELDED CABLE IS RECOMMENDED AS SHOWN. ADDITIONALLY, THE APPLICATION OF EARTH GROUND MUST BE IN PLACE AS SHOWN IN THIS DRAWING. FAILURE TO ADHERE TO SOUND WIRING AND GROUNDING PRACTICES MAY COMPROMISE SAFETY AND PERFORMANCE.

SAFETY GUIDELINES MAY REQUIRE THAT THIS DEVICE BE HOUSED IN AN APPROVED METAL ENCLOSURE OR SUB-SYSTEM, PARTICULARLY FOR APPLICATIONS WITH VOLTAGES GREATER THAN OR EQUAL TO 75VDC/50VAC.

4501-637C



SERIES 8xxA INTERPOSING RELAY CONNECTIONS

4501-634A